Government General Degree College, Singur

District Hooghly, West Bengal

DEPARTMENT OF ZOOLOGY

PROGRAMME OFFERED: B.Sc. ZOOLOGY HONOURS

Model Reference: Syllabus for Zoology (Honours), University of Burdwan,

With effect from 2017-2018

SCHEME FOR CBCS CURRICULUM:

[A]

Course Type	Number of Courses	Credits		
		Theory + Practical	Theory+ Practical	Total
Core Courses	14	14×4=56	14×2=28	84
Discipline Specific	04	4×4=16	4×2=8	24
Generic Elective	04	4×4=16	4×2=8	24
Language Courses & ENVS	02	4×1=4 2×1=2		6
Skill Enhancement Course	02	2×2=4		4
Total	26	98	44	142

[B]

Semester	Course Name	Course Detail	Credits
I	Ability Enhancement Compulsory Course–I	Environmental Studies	4
	Core course–I	Non-chordates I	4
	Core course–I Practical	Non-chordates I Lab	2
	Core course–II	Ecology	4
	Core course–II Practical	Ecology Lab	2
	Generic Elective–1*	Animal Diversity	4
	Generic Elective–1 Practical*	Animal Diversity Lab	2
II	Ability Enhancement Compulsory Course–II	Communicative English/MIL	2
	Core course–III	Non- chordates II	4
	Core course–III Practical	Non- chordates II Lab	2
	Core course–IV	Cell Biology	4
	Core course–IV Practical	Cell Biology Lab	2
	Generic Elective–2*	Comparative Anatomy & Developmental Biology of Vertebrates	4
	Generic Elective–2 Practical*	Comparative Anatomy & Developmental Biology of Vertebrates Lab	2
III	Core course–V	Chordates	4
	Core course–V Practical	Chordates Lab	2
	Core course–VI	Animal Physiology: Controlling and Coordinating Systems	4
	Core course–VI Practical	Animal Physiology: Controlling and Coordinating Systems Lab	2
	Core course–VII	Fundamentals of Biochemistry	4
	Core course – VII Practical	Fundamentals of Biochemistry Lab	2
	Skill Enhancement Course–1	Apiculture or Sericulture	2
	Generic Elective–3*	Physiology and Biochemistry	4
	Generic Elective–3 Practical*	Physiology and Biochemistry Lab	2

IV	Core course–VIII	Comparative Anatomy of Vertebrates	4
	Core course–VIII Practical	Comparative Anatomy of Vertebrates Lab	2
	Core course–IX	Animal Physiology: Life Sustaining Systems	4
	Core course–IX Practical	Animal Physiology: Life Sustaining Systems Lab	2
	Core course–X	Immunology	4
	Core course–X Practical	Immunology Lab	2
	Skill Enhancement Course-2	Medical Diagnostics or Aquarium Fish Keeping	2
	Generic Elective–4*	Genetics and Evolutionary Biology	4
	Generic Elective–4 Practical*	Genetics and Evolutionary Biology Lab	2
V	Core course–XI	Molecular Biology	4
	Core course–XI Practical	Molecular Biology Lab	2
	Core course–XII	Genetics	4
	Core course–XII Practical	Genetics Lab	2
	Discipline Specific Elective–1	Animal Biotechnology or Microbiology	4
	Discipline Specific Elective–1 Practical	Animal Biotechnology or Microbiology	2
	Discipline Specific Elective–2	Parasitology or Biology of Insects	4
	Discipline Specific Elective–2 Practical	Parasitology or Biology of Insects	2
VI	Core course–XIII	Developmental Biology	4
	Core course–XIII Practical	Developmental Biology Lab	2
	Core course–XIV	Evolutionary Biology	4
	Core course–XIV Practical	Evolutionary Biology Lab	2
	Discipline Specific Elective–3	Animal Behaviour or Wild life Conservation	4
	Discipline Specific Elective–3 Practical	Animal Behaviour or Wild life Conservation	2
	Discipline Specific Elective–4	Endocrinology or Reproductive Biology	4
	Discipline Specific Elective–4 Practical	Endocrinology or Reproductive Biology	2
			142

*For other subjects. For Zoology Hons. students, Generic Electives will be any subject(s) other than Zoology.

SEMESTER	CORE COURSE (With Practical)	GENERIC ELECTIVE	DISCIPLINE SPECIFIC ELECTIVE	SKILL ENHANCE-MENT COURSE	ABILITY ENHANCE MENT COMPULSORY COURSE
I	i. Non-chordates ii. Ecology	Animal Diversity	_____	_____	ENVS
II	iii. Non-chordates iv. Cell Biology	Comparative Anatomy & Developmental Biology of Vertebrates	_____	_____	Communicative Eng./ MIL
III	v. Chordate vi. Animal Physiology vii. Biochemistry	Physiology and Biochemistry	_____	Apiculture or Sericulture	
IV	viii. Comparative Anatomy ix. Animal Physiology x. Immunology	Genetics and Evolutionary Biology	_____	Medical Diagnostics OR Aquarium Fish Keeping	
V	xi. Molecular Biology xii. Genetics	_____	Animal Biotechnology OR Microbiology Parasitology OR Biology of Insects	_____	
VI	xiii. Developmental Biology xiv. Evolution		Animal Behaviour OR Wild Life Endocrinology OR Reproductive Biology		

Programme Outcome (PO):

Outcome Based Education (OBE) is necessary for showing a transparent picture of what the educators will deliver and most importantly, what the students will be able to do. The Zoology curriculum is organized for delivery and assessment to make sure that learning happens in the right direction. So, in order to have OBE, we need to have Outcome Based Curriculum (OBC), Outcome Based Learning & Teaching (OBLT) and Outcome Based Assessment (OBA).

The generic graduate attributes at B.U., which is applicable for Zoology Honours degree, are listed below:

(i) PO1: Subject knowledge - Apply knowledge of respective courses (different Core and GE courses) to make sense of new ideas and experiences to solve complex problems. Students completing this programme become adept in hands-on activities.

(ii) PO2: Problem analysis and solutions - Identify, formulate, get conversant with different recent trends of scientific works and analyse complex problems reaching substantiated conclusions using experiments, research, principles of biostatistics, and different aspects of natural sciences (core zoology, biophysics, biochemistry, biotechnology etc.).

Students also learn to design solutions for complex problems and processes that meet specified needs with appropriate consideration for public health and safety, and environmental considerations.

(iii) PO3: Ethics - Apply ethical principles and commit to professional ethics and responsibilities and norms of subject practice such as animal biotechnology.

(iv) PO4: Individual and team work - Field trips and academic excursions while studying zoology honours helps the students to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

(v) PO5: Communication - Communicate effectively on complex subject activities with the subject community and with society at large, such as being able to comprehend and write effective reports and design documentation, make presentations and give and receive clear instructions.

(vi) PO6: Diversified Expertise and Job opportunity - The students will be acquiring basic experimental skills in various techniques in the fields of genetics, molecular biology, biotechnology, qualitative and quantitative microscopy, enzymology and analytical biochemistry. These methodologies will provide an extra edge to our students, who wish to undertake higher studies can be used to pursue career as a scientist in plethora of industries in India or abroad by appearing in JAM, CUET, IISER, IISc, TIFR, GATE, and NET exams. Students undertaking skill enhancement courses like aquaculture, sericulture and apiculture will inculcate skills involved in rearing fish, bees and silk moth which would help them in starting their own ventures and generating self-employment making them successful entrepreneurs. Acquired skills in diagnostic testing, haematology, histopathology, staining procedures etc. used in clinical and research laboratories will provide them opportunity to work in diagnostic or research laboratory. Candidates find opportunities in government departments, environmental agencies, universities, colleges, biotechnological, pharmaceutical, environmental/ecological fields. At the end of Zoology Honours graduation, the students are likely to possess expertise which will provide them competitive advantage in pursuing higher studies from India or abroad; and seek jobs in academia, research or industries. Candidates may find jobs as Animal Behaviourist, Conservationist, Wildlife Biologist, Zoo Curator, Wildlife Educator, Zoology faculty, Forensic experts, Lab technicians, Veterinarians etc.

PROGRAM SPECIFIC OUTCOME (PSO):

(i) PSO1: Students enrolled in B.Sc. (Hons.) degree program in Zoology will study and acquire complete knowledge of disciplinary as well as allied biological sciences.

(ii) PSO2: Students will learn about various invertebrate and vertebrate members of the animal kingdom, the complex but wonderful evolutionary processes and behaviour and special features (anatomical and physiological) of animals.

(iii) PSO3: Students will understand concepts of Ecology, Cell biology, Taxonomy, Physiology, Biochemistry, Immunology, Endocrinology, Parasitology, Genetics, Molecular Biology, Biotechnology, Developmental Biology, Ethology and Economic Zoology.

(iv) PSO4: Understand the interactions between biota and their environments, ecological factors affecting the biodiversity and protection of endangered species, environmental conservation processes and its importance.

(v) PSO5: Students will gain knowledge of Small-Scale agro-industries like apiculture, sericulture, fishery and ornamental fishes.

(vi) PSO6: Understand the basic concepts of biochemistry, immunology, molecular biology, genetics, parasitology, endocrinology and their importance in human health and medicine.

(vii) PSO7: Through this course the students will get hands-on-training in zoology and allied disciplines. They will become acquainted with good laboratory practices and safety measures.

Course outcome:

Sl. No.	Name of the Course	Semester	Course Code	Course outcome
1.	NonChordates - I	I	CC-I (Theory)	1.1 Describing general taxonomic rules of non-chordate classification. 1.2 Know the Classification of invertebrates till Nematoda. 1.3 Development of clear concept on different invertebrate forms and their physiology. 1.4 Able to understand the diversification, specialty and pathogenicity.
			CC-I (Practical)	1.5 Identify and classify invertebrates by studying their external characters, prepare keys and know about their habits and habitats (Protists to Pseudocoelomates) 1.6 Preparation of stained whole mount of *Euglena*, *Amoeba* and *Paramoecium.* 1.7 Staining/mounting of any protozoa/helminth from gut of cockroach.

2.	Introduction to Ecology	I	CC-II (Theory)	2.1 Acquire knowledge and understanding about ecology, environment and their proper functioning. 2.2 Knowledge about interrelationship of animal, plants, microbes and their interactions with abiotic factors. 2.3 Develop idea and concept of numerous protected zones in wildlife, and different conservation strategies.
			CC-II (Practical)	2.4 Study of life tables and plotting of survivorship curves. 2.5 Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community. 2.6 Study of an aquatic ecosystem (phytoplankton and zooplankton, measurement of area, temperature, determination of pH and free CO2). 2.7 Students prepare a report on a visit to National Park/Biodiversity Park/Wild life sanctuary/ Biodiversity Centre/ Any Museum/Sea shore.
3.	Non-Chordates - II	II	CC-III (Theory)	3.1 Understanding the evolution of coelom and metamerism. 3.2 Know the Classification, diversity and physiology of invertebrates till Echinodermata. 3.3 Knowledge of phylum Hemichordata and their relationship with non-chordates and chordates.
			CC-III (Practical)	3.4 Identify and classify invertebrates (Annelids to Echinoderms) by studying their external characters, prepare keys and know about their habits and habitats. 3.5 Understand the internal organ systems of non-chordate (Earthworm and *Periplaneta*) – Nervous system, Digestive system and Mouth parts. 3.6 Students submit a 'Project Report' on any related topic on larval forms (arthropods and molluscs)
4.	Cell Biology	II	CC-IV (Theory)	4.1 Have a knowledge about Ultra-structure and composition of Plasma membrane: Fluid mosaic model, Transport across membranes, Cell junctions and Desmosomes. 4.2 Study the ultrastructure and functions of various cell organelles such as

				ribosome, Endoplasmic reticulum, Golgi apparatus, Nucleus. 4.3 Know the different aspects of cell cycle and its regulation, Concept of oncogenes and tumour suppressor genes and its relation to cancer. 4.4 Understand Cell signalling transduction pathways; Types of signalling molecules and receptors.
			CC-IV (Practical)	4.5 Prepare temporary stained squash preparation of onion root tip to study various stages of mitosis; Prepare temporary stained squash of grasshopper testis to identify various stages of meiosis. 4.6 Students learn the preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells. 4.7 They also study cell viability by Trypan Blue staining from onion root tip or blood cells.
5.	Chordates	III	CC-V (Theory)	5.1 Have a knowledge on general characteristics and classification of Chordates: from protochordates to mammals. 5.2 Learn about some special features in various chordate groups: Migration in fishes, Parental care in fishes, Swim bladder in fishes; Metamorphosis, Parental care in Amphibia; Poison apparatus and Biting mechanism in Snake. 5.3 Have a knowledge about Exoskeleton and migration in Birds; Principles and aerodynamics of flight; Exoskeleton derivatives of mammals; Adaptive radiation in mammals with reference to locomotory appendages; Echolocation in Micro chiropterans and Cetaceans 5.4 Know about different Zoogeographical realms, Plate tectonic and Continental drift theory, distribution of birds and mammals in different realms.
			CC-V (Practical)	5.5 Learn to identify and classify vertebrates (protochordates to mammals) by studying their external characters. 5.6 Key for Identification of poisonous and non-poisonous snake.

				5.7 Dissect Pecten from Fowl head to understand the mechanics of vision in birds. 5.8 Dissection of brain and pituitary of any major carp. 5.9 Power point presentation on any two animals (different Classes) studied by the students to emphasize the importance of biodiversity, habit, habitat or behaviour.
6.	Animal Physiology: Controlling & Coordinating Systems	III	CC-VI (Theory)	6.1 Develop a concept of the structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue, as well as bones and cartilages. 6.2 Have a clear understanding of the physiology of excretion, skeletal muscle contraction, nerve impulse and mammalian reproduction. 6.3 Have knowledge of the different endocrine and neuro-endocrine glands and their functions; Endocrine regulation of oestrous and menstrual cycle. 6.4 Learn about the mechanism of hormone action and the signal transduction pathways for steroidal and non-steroidal hormones.
			CC-VI (Practical)	6.5 Students learn to Record simple muscle twitch with electrical stimulation (or Virtual) 6.6 Understand the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex) by demonstration. 6.7 Preparation of temporary mounts of Squamous epithelium and Striated muscle fibres. 6.8 Identification of permanent slides of Mammalian Cartilage, Bone, Pituitary, Liver, Kidney, Intestine, Lung, Pancreas, Testis, Ovary, Adrenal, Thyroid 6.9 Learn Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues from above.
7.	Fundamentals of Biochemistry	III	CC-VII (Theory)	7.1 Learn the Structure and Biological importance of Carbohydrates, Lipids, Proteins and Nucleic acids; their catabolism and anabolism.

				7.2 Students will understand the nature, mechanism, and kinetics of enzyme action. 7.3 Learn about Oxidative Phosphorylation: Redox systems and Mitochondrial Electron Transport Chain.
			CC-VII (Practical)	7.4 Qualitative tests of functional groups in carbohydrates (Benedict's test), proteins (Biuret's test) and lipids (Saponification number). 7.5 Paper chromatography of amino acids; Quantitative estimation of protein by Lowry Method 7.6 Demonstration of protein separation by SDS-PAGE. 7.7 To study the enzymatic activity of Salivary amylase and Catalase in *Cajanus cajan*.
	Sericulture/ Apiculture (Our college students study 'Sericulture')	III	Skill Enhancement Course-1 (SEC-1)	• Know about the history and present status of Silk in India and abroad. • Learn about the biology and rearing of silkworms; Spinning, harvesting and storage of cocoons. • Know about the Pests and Diseases affecting Silk Worms; Prevention and Control of such diseases. • Prospect of Sericulture in India - employment, potential in mulberry and non-mulberry sericulture.
8.	Comparative Anatomy of Vertebrates	IV	CC-VIII (Theory)	8.1 Know about the Structure, function and derivatives of integument in amphibian, birds and mammals. 8.2 Comparative anatomical account of different organs and organ systems in different Vertebrate Classes (Skeletal system, Digestive system, Respiratory system, Circulatory system, Urinogenital system, Nervous system and Sense organs). 8.3 Through this students' learn the aspects of evolutionary changes that occurred to the animal's body structures.
			CC-VIII (Practical)	8.4 Learn to identify different fish scales (such as Cycloid & Ctenoid) and prepare whole mounts. 8.5 Study of disarticulated skeleton of Toad, Pigeon and Guineapig.

				8.6 Know the anatomy of Carapace and plastron of turtle from model and chart (Demonstration). 8.7 Able to identify mammalian skulls – both herbivorous (Guineapig) and carnivorous animal (Dog). 8.8 Study and Dissection of Afferent arterial system, brain, pituitary in Carp.
9.	Animal Physiology: Life Sustaining Systems	IV	CC-IX (Theory)	9.1 Study the physiology of Digestion - structural organisation and function of digestive tract (GI), Role of enzymes and absorption of Carbohydrates, Lipids, Proteins and Nucleic acids in Humans. 9.2 Study the physiology of Respiration - Mechanism of Respiration, Respiratory volumes and capacities, Transport of Oxygen and Carbon dioxide in blood, Dissociation curves and the factors influencing it, Respiratory pigments and Carbon monoxide poisoning. 9.3 Study the physiology of Circulation and function of Heart - Knowledge of Structure and functions of haemoglobin, Blood clotting system, Haematopoiesis, ABO Blood grouping and Rh factor, Coronary Circulation, Structure and working of myocardial fibres, Origin and conduction of cardiac impulses, Cardiac Cycle and cardiac output. 9.4 Physiological classification based on thermal biology (Extreme temperature adaptations), Osmoregulation in aquatic vertebrates and invertebrates.
			CC-IX (Practical)	9.5 Learn to determine ABO Blood group 9.6 Learn to enumerate RBCs and WBCs using haemocytometer 9.7 Estimation of haemoglobin using Sahli's haemoglobinometer 9.8 Preparation of haemin crystals 9.9 Recording of blood pressure using a Sphygmomanometer
10.	Immunology	IV	CC-X (Theory)	10.1 Overview of Immune System with respect to health and diseases, Historical perspective, Cells and organs associated with the Immune system, Concept of Innate and Adaptive immunity.

				10.2 Learn in details about Antigen, Antibody, Cytokines, Adjuvants, Haptens, Complement proteins and its activation, MAC formation, MHC. 10.3 Know about Immuno-techniques and Immuno-assays and their applications. 10.4 Know about Hypersensitivity reactions; Gell and Coombs' classification. 10.5 Immunology of various diseases - Malaria, Filariasis, Dengue and Tuberculosis. 10.6 Learn about various types of vaccines; Active & passive immunization (Artificial and natural).
			CC-X (Practical)	10.7 Identify lymphoid organs in human through model/photograph. 10.8 Histological study of spleen, thymus and lymph nodes through slides/photographs 10.9 Prepare stained blood film to identify various types of blood cells. 10.10 Do the Total count (TC) and Differential count (DC) of WBC 10.11 Learn about ELISA by the Demonstration of a teaching kit.
	Medical Diagnostics/ Aquarium Fish Keeping (Our college students' study 'Aquarium Fish Keeping')	IV	Skill Enhancement Course-2 (SEC-2)	• Students learn the potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes. • Develop knowledge about the biology of carious aquarium fishes - Common characters and sexual dimorphism of Freshwater and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue-morph, Anemone fish and Butterfly fish. • Learn about the use of live fish feed organisms, preparation and composition of formulated fish feeds, aquarium fish as larval predator. • Knowledge about various means of Live fish transport - Fish handling, packing and forwarding techniques. • General Aquarium maintenance, budget for setting up an Aquarium Fish Farm as a Cottage Industry.
11.	Molecular Biology	V	CC-XI (Theory)	11.1 Know the salient features of Nucleic acids (DNA & RNA), Chargaff's Rule, Hypo and Hyperchromic shift;

				Watson and Crick Model of DNA; RNA types & Functions. 11.2 Develop concept about Central Dogma – Detailed mechanism of Replication, Transcription and Replication – in both prokaryotes and eukaryotes. 11.3 Genetic code and Wobble hypothesis. 11.4 Learn about Post Transcriptional Modifications and Processing of Eukaryotic RNA - Capping and Poly A tail, Splicing & alternative splicing, Split gene concept, RNA editing, Exon shuffling. 11.5 Know about the regulation of gene expression in prokaryotes and eukaryotes; Gene silencing, Genetic imprinting. 11.6 Learn about the molecular aspects of various DNA damage and repair Mechanisms. 11.7 Know about the Molecular Techniques - PCR, Western blot, Southern blot, Northern Blot and DNA sequencing.
			CC-XI (Practical)	11.8 Students learn the preparation of polytene chromosome from Dipteran larva of *Chironomus/ Drosophila*; Identification of polytene and lampbrush chromosome from photograph. 11.9 Isolation and quantification of genomic DNA using spectrophotometer (A260 measurement) (demonstration only). 11.10 Demonstrate agarose gel electrophoresis for DNA. 11.11 Study and interpretation of electron micrographs/ photographs showing DNA replication, Transcription, Split genes. 11.12 Preparation of liquid and solid bacterial culture media, slant and stab; Demonstration of antibiotic sensitivity or resistance of bacteria to antibiotic discs.
12.	Genetics	V	CC-XII (Theory)	12.1 Understand the principles of Mendelian Genetics and its extension - Laws of inheritance and its exceptions, Incomplete dominance

				and co-dominance, Epistasis Multiple alleles, Lethal alleles, Pleiotropy; Sex-linked, sex-influenced and sex-limited inheritance; Polygenic Inheritance. 12.2 Concept building on Linkage, Crossing Over and Chromosomal Mapping. 12.3 Know about Chromosomal aberrations and its effects; Genetic and molecular basis of Mutations, effects of physical and chemical mutagens. 12.4 Learn Genetic and molecular mechanism of Sex-determination in *Drosophila* and Humans. 12.5 Study Extra-chromosomal and maternal Inheritance. 12.6 Study bacterial and Phage genetics - Conjugation, Transformation, Transduction; Complementation test in Bacteriophage. 12.7 Learn about Transposable Genetic Elements in bacteria, maize, *Drosophila* and Humans.
			CC-XII (Practical)	12.8 Students perform Chi-square analyses. 12.9 Solving genetic problems of linkage maps on *Drosophila.* 12.10 Students learn to identify various chromosomal aberrations in *Drosophila* and Humans from photograph. 12.11 Pedigree analysis of some human inherited traits (X-linked dominant, X-linked recessive, autosomal dominant, autosomal recessive, Y-linked).
	Animal Biotechnology or Microbiology (We have adopted Animal Biotechnology)	V	Department Specific Elective – 1 (DSE-1) Theory	• Knowledge about the organization of prokaryotic and eukaryotic genome; Concept of genomics. • Learning Recombinant DNA Technology; Concept building on Principles of Gene manipulation, Cloning and their applications in Biotechnology. • Various Molecular Biology Techniques – their principals and applications - Southern, Northern and Western blotting, DNA sequencing: Sanger method, Polymerase Chain Reaction, DNA Fingerprinting and DNA microarray.

				• Concept of Transgenics and Genetically Modified Organisms; Applications of transgenic animals - Production of pharmaceuticals, production of donor organs, knockout mice. • Know about various Cell Culture Techniques and Applications, Genetic diseases and Gene Therapy.
			DSE – 1 Practical	• Students learn to construct linear restriction map from the data provided. • Calculation of transformation efficiency from the data provided. • Study and identification of various molecular biology techniques through photographs -Southern Blotting, Northern Blotting, Western Blotting, DNA Sequencing (Sanger's Method), PCR, DNA fingerprinting • Students submit a Project report on animal cell culture
	Parasitology or Biology of Insects (We have adopted Parasitology)	V	Department Specific Elective – 2 (DSE-2) Theory	• Students acquire knowledge on Parasitism, Parasite, Parasitoid, Vectors and Host-Parasite relationships. • Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of some parasitic Protists - *Giardia intestinalis, Trypanosoma gambiense, Leishmania donovani* • Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of parasitic Helminths - *Schistosoma haematobium, Taenia saginata* • Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of some nematodes – *Ascaris lumbricoides, Ancylostoma duodenale, Wuchereria bancrofti*, *Trichinella spiralis, Brugia malayi*; Nematode plant interaction. • Study of various parasitic arthropods - ticks, mites, Lice, Flea and Bug. • Study various Parasite Vertebrates - Cookicutter Shark, Hood Mocking bird, Vampire bat.

			DSE – 2 Practical	• At the end of this Semester students learn to identify life stages of various parasitic protists, helminths, nematodes through permanent slides or microphotographs. • Identification of plant parasitic root knot nematode, *Meloidogyne* from the soil sample • Identification of various parasitic arthropods - *Pediculus humanus*, *Xenopsyll acheopis* and *Cimex lectularius* through permanent slides or photographs. • Isolation and fixation of nematode or cestode parasites from the intestine of hen. • Students submit a project report on any parasite of vertebrates.
13.	Developmental Biology	VI	CC-XIII (Theory)	13.1 Students learn about gametogenesis, Fertilization and early embryonic developments - Cleavage, Blastulation, Fate map construction, Gastrulation, Embryonic induction and Organizer concept. 13.2 Know about extra-embryonic membranes in birds, implantation of embryo in humans and Placentation. 13.3 Students have a concept of molecular Induction in Vertebrate Brain and Eye development; Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration. 13.4 Develop knowledge of *In vitro* fertilization (IVF), Stem cell, Applications of stem cell therapy in bone marrow transplantation, Amniocentesis and Teratogenesis.
			CC-XIII (Practical)	13.5 Students learn to identify the different developmental stages of chick embryo. 13.6 Students learn to identify the developmental stages and life cycle of *Drosophila.* 13.7 Students are able to identify the different sections of placenta. 13.8 Students prepare a Project report on *Drosophila* culture/chick embryo development.
14.	Evolutionary Biology	VI	CC-XIV (Theory)	14.1 Students learn about the origin of life - Chemogeny, RNA world, Biogeny,

				Origin of photosynthesis, Evolution of eukaryotes 14.2 Have a knowledge of Lamarckism, Darwinism and Neo-Darwinism 14.3 Learn about Geological time scale, Molecular Clock, evolution of horse and humans. 14.4 Students have a concept of Natural selection, Synthetic theory, Hardy-Weinberg equilibrium, Genetic drift, founder effect and population bottleneck. 14.5 Students develop knowledge of Speciation, Adaptive radiation; have a concept of back ground and mass extinctions, K-T extinction. 14.6 Students have a knowledge of construction and interpretation of Phylogenetic tree using parsimony, convergent and divergent evolution; learn the basics of bioinformatics.
			CC-XIV (Practical)	14.7 Students study of fossils from models/pictures 14.8 Study homology and analogy from suitable specimens 14.9 Students work out problems on Hardy-Weinberg Law by Chi-square analysis. 14.10 Graphical representation and interpretation of data of height /weight of a sample of 100 humans in relation to the age and sex.
	Animal Behaviour or Wild life Conservation (We have adopted Animal Behaviour)	VI	Discipline Specific Elective–3 (DSE-3 Theory)	• Students learn about the Origin and history of Ethology; Methods and recording of a behaviour • Students learn in details about Patterns of Behaviour found in animals • They learn about Social Behaviour of animals like termites and honey bees, Altruism, and Wide aspects of Sexual behaviour in animals. • Students learn about Chronobiology, Circadian Rhythm, Role of Melatonin, Photoperiods and their role in animal reproduction.
			DSE-3 Practical	Students carry out various field-based activities • Study of nests and nesting habits of the birds and social insects. • Study of the behavioural responses of woodlice to dry and humid conditions.

				• Study of geotaxis behaviour in earthworm. • Study of phototaxis behaviour in insect larvae. • Visit to Forest/Wildlife Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report. • Study of circadian functions in humans (daily eating, sleep and temperature patterns).
	Endocrinology or Reproductive Biology (We have adopted Endocrinology)	VI	Discipline Specific Elective–4 (DSE-4 Theory)	• Students learn about Endocrine systems, Classification, Characteristics and Transport of Hormones, Neurosecretions and Neurohormones. • Students study about pineal gland; pituitary gland, hormones, their functions; Hypothalamo-hypophysial Axis. • Have knowledge of the endocrine glands, their functions and disorders caused by their hypo or hypersecretions. • Students learn about the molecular function of different classes of hormones (steroidal, non-steroidal hormones) and their regulation • Learn about Bioassays of hormones using RIA and ELISA; hormonal control of ovulation in rats and humans; Multifaceted role of Vasopressin and Oxytocin; Hormonal regulation of parturition.
			DSE-4 Practical	• Students learn to dissect and display Endocrine glands in laboratory bred rat. • They learn to identify with characters T.S. of all the endocrine glands. • Students learn the techniques of tissue fixation, embedding in paraffin, microtomy and slide preparation of any endocrine gland. • Demonstration of hormone assay through ELISA from available teaching kit.